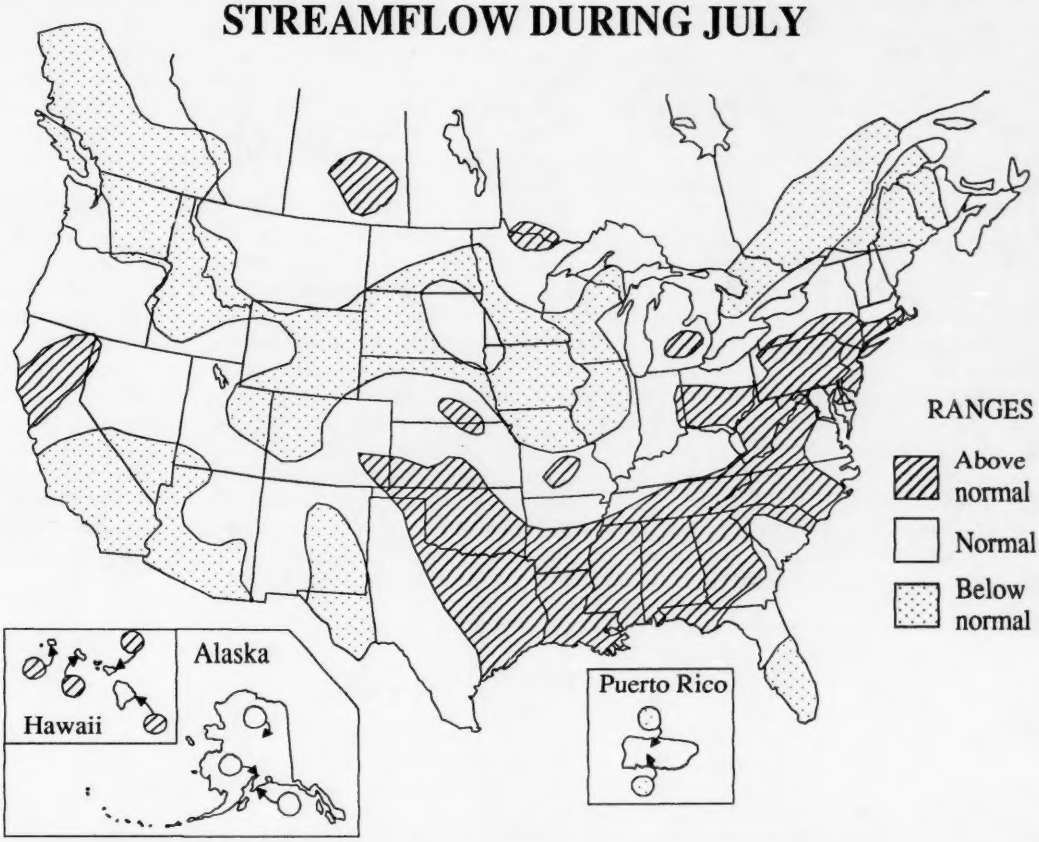
National Water Conditions

UNITED STATES
Department of the Interior
Geological Survey

CANADA
Department of the Environment
Water Resources Branch

JULY 1989

STREAMFLOW DURING JULY



Heavy rains caused floods exceeding previous peaks of record and also the 100-year recurrence interval on some streams in northern Delaware. Three persons drowned and damages in New Castle County were estimated at $5 million.

Streamflow was in the normal to above-normal range at 68 percent of the index stations in southern Canada, the United States, and Puerto Rico during July, compared with 73 percent in those ranges during June. Below-normal range streamflow occurred in 29 percent of southern Canada and the conterminous United States during July compared with 27 percent during June. Total July flow for the index stations in the conterminous United States and southern Canada was 16 percent above median after a 28 percent decrease in streamflow from June to July. New monthly extremes occurred at 10 index stations during July, compared with 12 new extremes during June.

July streamflow ranged from 39 percent below median to 214 percent above median in five areas affected by the drought of 1988. Flow increased from that during June in California and the Southeast, and decreased in the other three areas

The combined flow of the 3 largest rivers in the lower 48 States--Mississippi, St. Lawrence, and Columbia--averaged 18 percent above median and in the above-normal range during July.

Monthend index reservoir contents for July 1989 were in the below-average range at 32 of 100 reporting sites, compared with 30 of 100 during June 1989. About the same number of reservoirs had contents in the above-average range.

Mean July elevations at the four master gages on the Great Lakes (provisional National Ocean Service data) were in the normal range on all four lakes.

Utah's Great Salt Lake declined 0.65 foot to 4,205.35 feet above National Geodetic Vertical Datum of 1929 on July 31.

SURFACE-WATER CONDITIONS DURING JULY 1989

Heavy rains caused floods exceeding previous peaks of record and also the 100-year recurrence interval on some streams in northern New Castle County, Delaware. The Elsmere, Wilmington, Stanton, and Newark areas were most severely affected. Three persons drowned and damages in New Castle County were estimated at $5 million.

Hydrologic drought continued in parts of the central and western United States during July. Persistence of non-normal range streamflow from June to July is shown on page 4. Streamflow was in the normal to above-normal range at 68 percent of the 190 index stations in southern Canada, the United States, and Puerto Rico during July, compared with 73 percent of 190 stations in those ranges during June, and 48 percent of 191 stations in those ranges during July 1988. Below-normal range streamflow occurred in 29 percent of southern Canada and the conterminous United States during July compared with 27 percent during June, and 50 percent during July 1988. Total July flow of 2,116,010 cfs for the 180 reporting index stations in the conterminous United States and southern Canada was 16 percent above median after a 28 percent decrease in streamflow from June to July, and 101 percent more than flow during July 1988. (See graphs on page 4.)

Streamflow conditions during July 1989 and July 1988 are shown by maps on page 5. In 1989, flows are in the above-normal range in much of the East, and in the Gulf Coast States, except Florida. The total area covered by above-normal range flow is 19 percent. More than one-third of the rest of southern Canada and the United States is covered by below-normal range flow: from southern California to eastern Wisconsin. By contrast, below-normal range flow occurred in 50 percent of the area and above-normal range flow occurred in only 6 percent of the area during July 1988.

New monthly extremes (table and graphs on pages 6-7) occurred at 10 index stations during July, compared with 12 during June. There were new lows at stations in Quebec (2) and in Iowa, and new highs at stations in South Carolina, Tennessee, Louisiana (2), Arkansas, Texas, and Hawaii.

July streamflow ranged from 39 percent below median (Northern Great Plains) to 214 percent above median (Southeast) in five areas (graphs on page 8) affected by the drought of 1988. Flow increased from that during June in California (23 percent) and the Southeast (11 percent), but decreased in the Pacific Northwest (53 percent), Northern Great Plains (35 percent), and the Western Great Lakes (59 percent). Graphs of actual streamflow in the five areas for each month of the 1988 and 1989 water years, and also 1951-80 median streamflow for each month are on page 9.

The combined flow of the 3 largest rivers in the lower 48 States—Mississippi, St. Lawrence, and Columbia—averaged 1,146,200 cfs (18 percent above median and in the above-normal range) during July, but 18 percent less than during June. Flow of the Columbia River was in the below-normal range for the second consecutive month. Flow of the Mississippi River was in the above-normal range for the second consecutive month after a below-normal range May. Flow of the St. Lawrence River was in the normal range for the second consecutive month after below-normal range flow during April and May. Hydrographs for both the combined and individual flows of the "Big 3" are on page 10. Dissolved solids and water temperatures at five large river stations are also given on page 10. Flow data for the "Big 3" and 42 other large rivers are given in the Flow of Large Rivers table on page 11.

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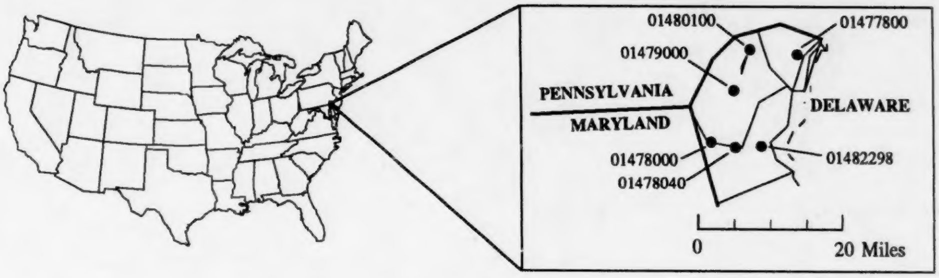
FLOODS OF JULY 1989 IN DELAWARE



Provisional data; subject to revision

FLOOD DATA FOR SELECTED SITES IN DELAWARE, JULY 1989

				Maximum flood previously known			Maximum during present flood				
							Discharge				Recur-
WRD Station number	Stream and place of determination	Drainage area (square miles)	Period of known floods	Date	Stage (feet)	Discharge (cfs)	Date	Stage (feet)	Cfs	Cfs per square mile	rence interval (years)
	DELAWARE RIVER BASIN										
01477800	Shellpot Creek at Wilmington	7.46	1945-	Sept. 13, 1971	11.91	6,850	July 5	13.76	8,040	1,077	[a]1.15
01478000	Christina River at Coochs Bridge	20.5	1943-	May 1, 1947	12.41	4,330	5	13.12	5,530	270	[a]1.12
01478040	Christina River near Bear	40.6	1978-	May 19, 1988	11.57	3,470	5	14.34	7,500	185	[a]1.05
01479000	White Clay Creek near Newark	89.1	1932-36, 1943-57, 1959-	June 22, 1972	17.74	9,080	5	16.55	11,600	130	[a]1.05
01480100	Little Mill Creek near Elsmere	6.70	1963-	Aug. 10, 1967	8.58	3,960	5	8.8	4,400	657	46
01482298	Red Lion Creek near Red Lion	3.08	1978-	Feb. 26, 1979	6.51	221	5	7.4	330	107	b

[a]Recurrence interval greater than 100 years. Value shown is approximate ratio of discharge to that of 100-year flood.

b Not determined

Monthend index reservoir contents for July 1989 were in the below-average range (below the monthend average for the period of record by more than 5 percent of normal maximum contents) at 32 of 100 reporting sites, compared with 30 of 100 during June 1989, including most reservoirs in Nebraska, the Dakotas, Wyoming, Montana, California, Nevada, and Colorado. About the same number of reservoirs had contents in the above-average range, including most reservoirs in Canada, Massachusetts, New Jersey, the Carolinas, the Tennessee Valley, Alabama, Oklahoma,Texas, and Arizona. Reservoirs with contents in the below-average range and lower than last year (with normal maximum contents of at least 1,000,000 acre-feet) were: International Falcon and Lake Travis, Texas; Lake McConaughy, Nebraska; Lake Sakakawea, North Dakota; Lake Oahe and Lake Francis Case, South Dakota; Canyon Ferry and Fort Peck, Montana; the Pathfinder and associated reservoirs, Wyoming; Bear Lake, Idaho-Utah; Pend Oreille Lake, Idaho; Franklin D. Roosevelt Lake, Washington; and also Pine Flat, Clair Engle Lake, and Lake Berryessa, all in California. Graphs of contents for seven reservoirs are shown on page 12 with contents for the 100 reporting reservoirs given on page 13.

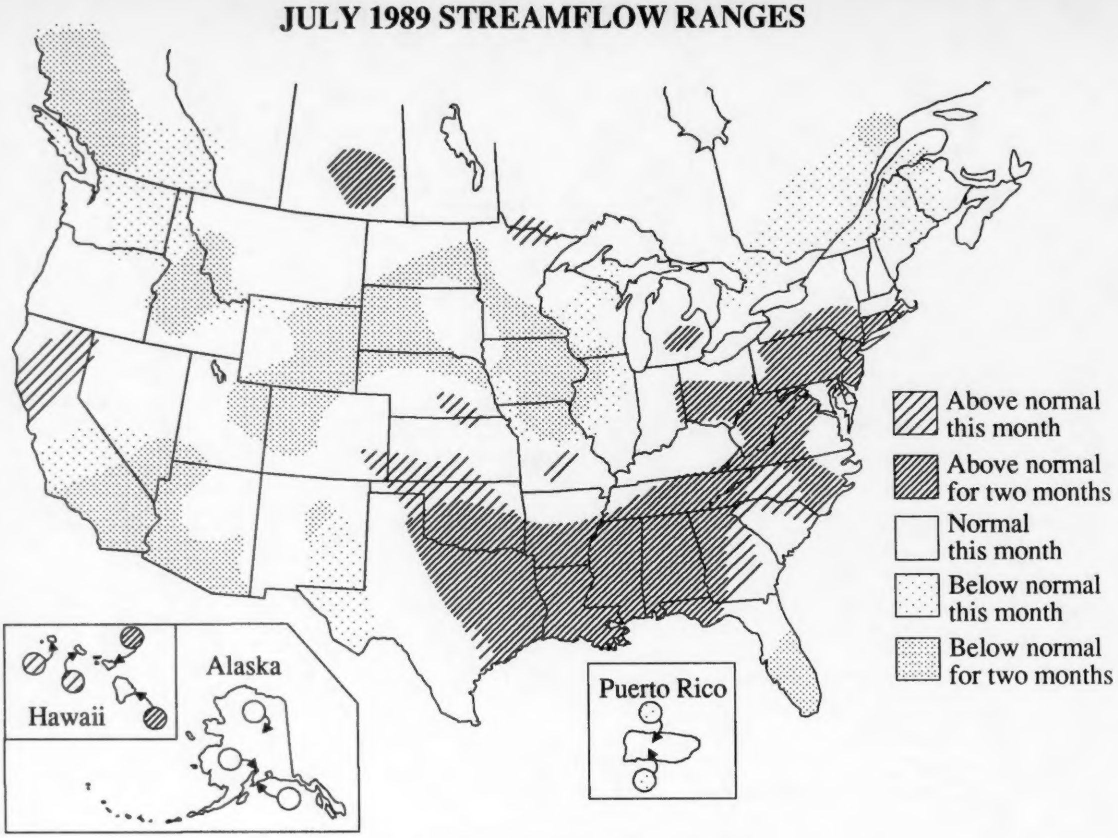
Mean July elevations at the four master gages on the Great Lakes (provisional National Ocean Service data) were in the normal range on all four lakes. Levels rose from those for June on Lake Superior and Lake Huron, but declined on Lake Erie and Lake Ontario. July 1989 levels ranged from 0.11 foot (Lake Huron) higher to 0.07 foot lower (Lake Ontario) than those for June. Monthly means have been in the normal range for 9 months on Lake Superior, 24 months on Lake Huron, 16 months on Lake Erie, and 3 months on Lake Ontario. July 1989 levels ranged from 1.09 feet higher (Lake Superior) to 0.12 foot lower (Lake Huron) than those for July 1988. Stage hydrographs for the master gages on Lake Superior, Lake Huron, Lake Erie, and Lake Ontario are on page 14.

Utah's Great Salt Lake (graph on page 14) declined 0.65 foot to 4,205.35 feet above National Geodetic Vertical Datum of 1929 on July 31. The lake has declined 1.45 feet since the seasonal high of May 1-15, is 2.70 feet lower than at the end of July 1988, and is also 6.50 feet lower than the maximum of record which occurred in June 1986 and March-April 1987.

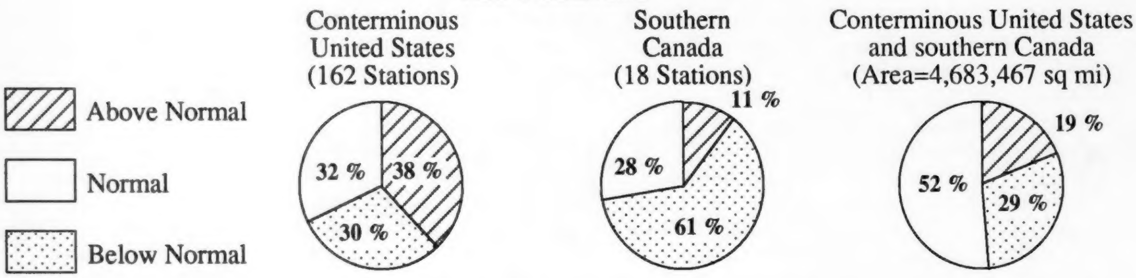
Precipitation in the United States during July 1989 (provisional National Weather Service) was highly variable (maps on page 15), with sharp contrasts in many areas. For example, 50-75 percent of normal precipitation fell in the area comprising western Virginia, eastern Kentucky, and southern West Virginia, while 150-200 percent of normal precipitation fell in areas to the east, south, and west. The Palmer Drought Severity maps for July 1 and 29, 1989 are shown on page 18.

August-October 1989 outlook maps for both temperature and precipitation are on page 19. Precipitation is likely to be above median in an area of varying width from the western Great Lakes to southeastern Louisiana-southwestern Mississippi. Below-median precipitation is likely in an area extending from southwestern Texas to southeastern Arizona.

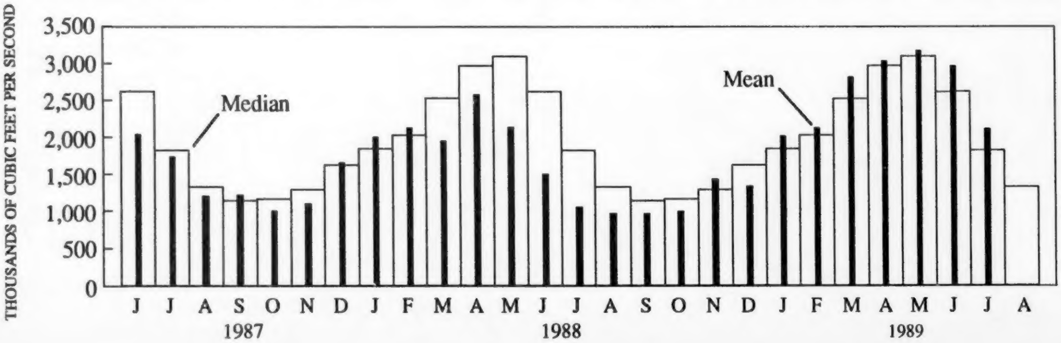
JULY 1989 STREAMFLOW RANGES



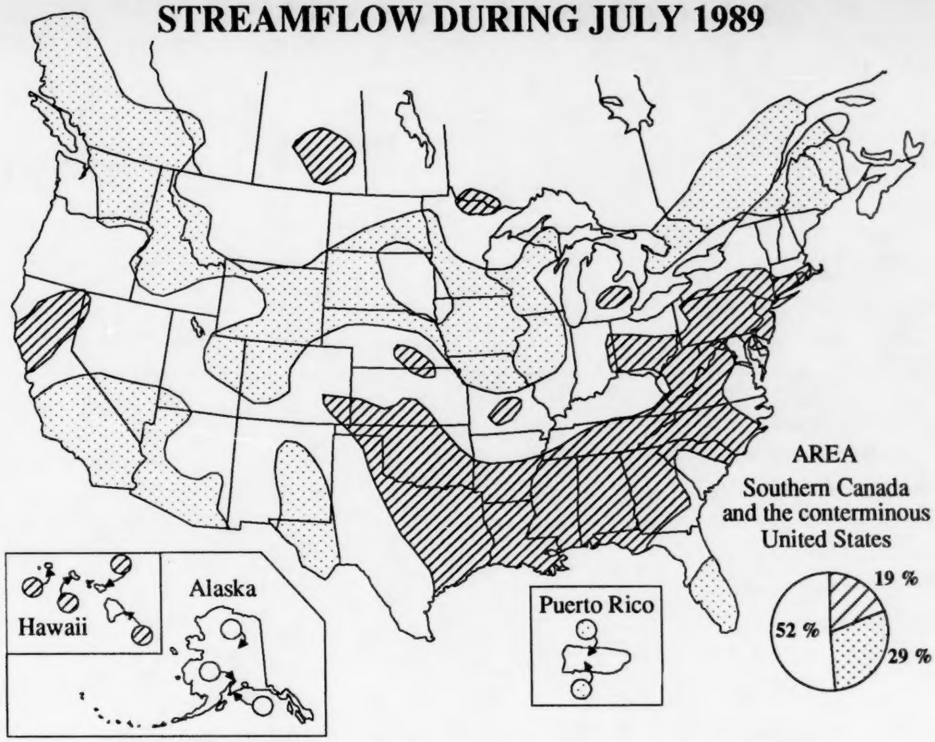
SUMMARY OF JULY 1989 STREAMFLOW FLOW RANGES



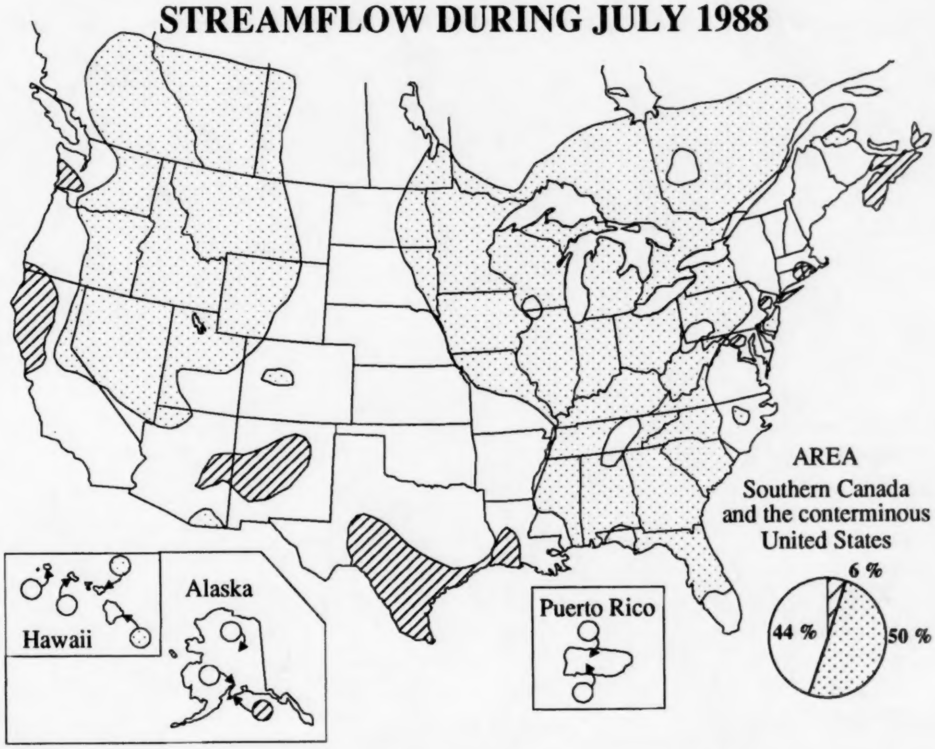
COMPARISON OF TOTAL MONTHLY MEANS WITH TOTAL MONTHLY MEDIANS



STREAMFLOW DURING JULY 1989



STREAMFLOW DURING JULY 1988



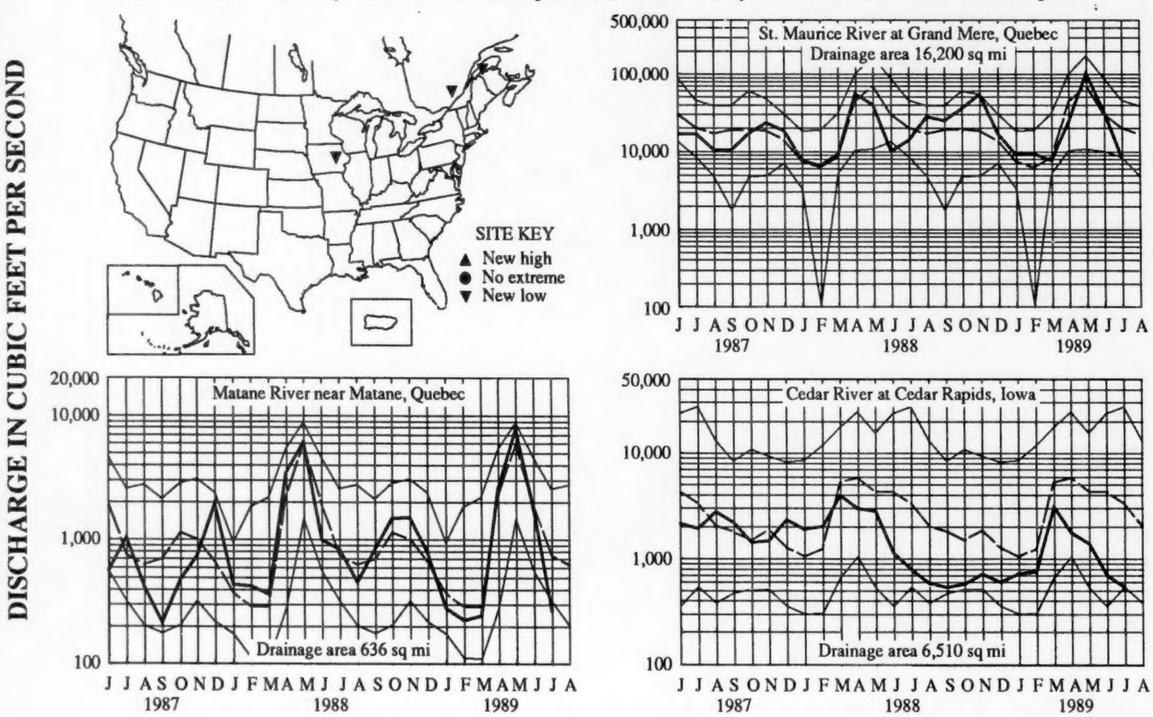
Above-normal range   Normal range   Below-normal range

NEW EXTREMES DURING JULY 1989 AT STREAMFLOW INDEX STATIONS

Station number	Stream and place of determination	Drainage area (square miles)	Previous July extremes (period of record): Years of record	Previous July extremes (period of record): Monthly mean in cfs (year)	Previous July extremes (period of record): Daily mean in cfs (year)	July 1989: Monthly mean in cfs	July 1989: Percent of median	July 1989: Daily mean in cfs	July 1989: Day
			LOW FLOWS						
02QB001	Matane River near Matane, Quebec	636	62	318 (1955)	191 (1955)	269	36	...	...
02NG001	St. Maurice River at Grand Mere, Quebec	16,200	69	8,300 (1933)	7,420 (1969)	8,200	41	...	...
05464500	Cedar River at Cedar Rapids, Iowa	6,510	86	538 (1911)	236 (1934)	533	16	399	15
			HIGH FLOWS						
02131000	Pee Dee River at Peedee, South Carolina	8,830	50	21,520 (1975)	58,000 (1975)	26,450	465	...	...
03434500	Harpeth River near Kingston Springs, Tennessee	681	64	988 (1972)	13,000 (1972)	1,064	477	4,390	6
07352000	Saline Bayou near Lucky, Louisiana.	154	48	278 (1940)	1,460 (1940)	992	3,690	6,550	1
07363500	Saline River near Rye, Arkansas	2,102	51	3,141 (1960)	14,500 (1960)	8,185	3,480	14,300	26
08013500	Calcasieu River near Oberlin, Louisiana	753	52	3,574 (1941)	7,900 (1941)	9,082	5,400	51,100	1
08033500	Neches River near Rockland, Texas	3,636	85	6,657 (1905)	16,900 (1919)	11,420	4,140	41,500	2
16700000	Waiakea Stream near Mountain View, Hawaii, Hawaii	17.4	58	24.0 (1967)	50 (1958)	24.1	319	35	20

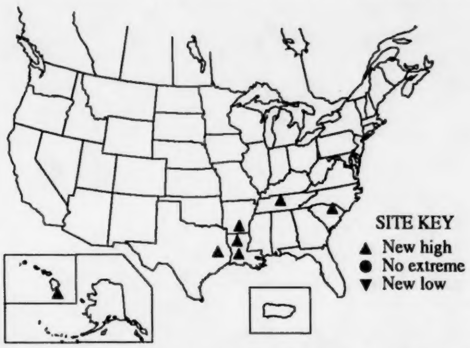
MONTHLY MEAN DISCHARGE OF SELECTED STREAMS

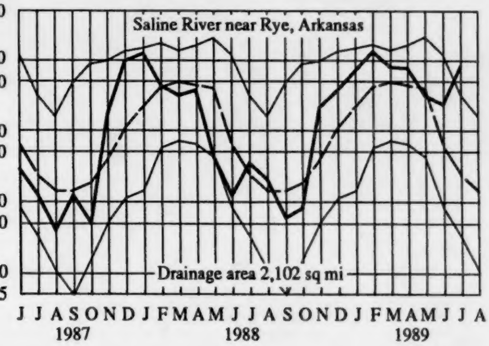
Area between light-weight solid lines indicates range between highest and lowest record for the month. Dashed line indicates median of monthly values for reference period, 1951-80. Heavy line indicates mean for current period.



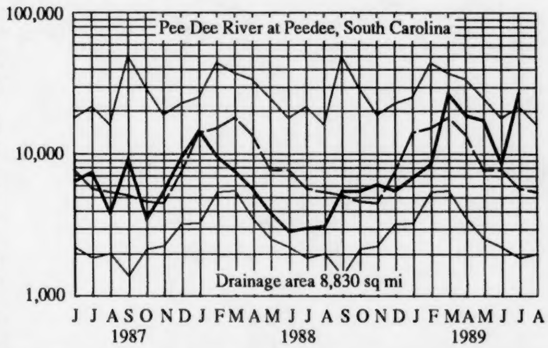
MONTHLY MEAN DISCHARGE OF SELECTED STREAMS

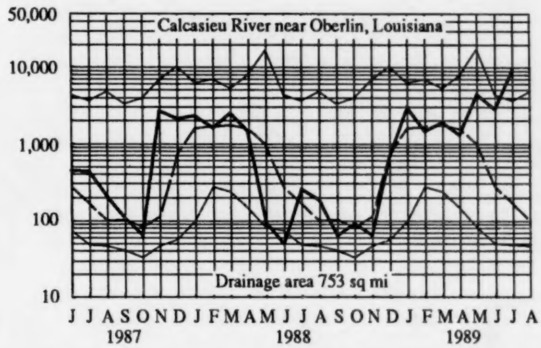
Area between light-weight solid lines indicates range between highest and lowest record for the month. Dashed line indicates median of monthly values for reference period, 1951-80. Heavy line indicates mean for current period.

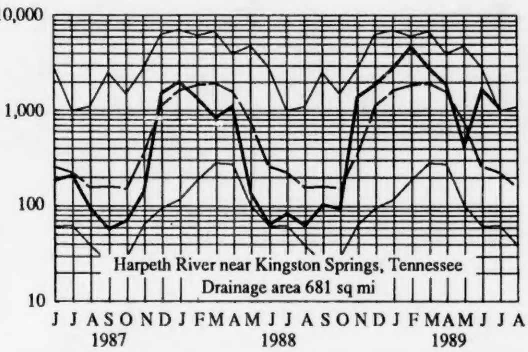


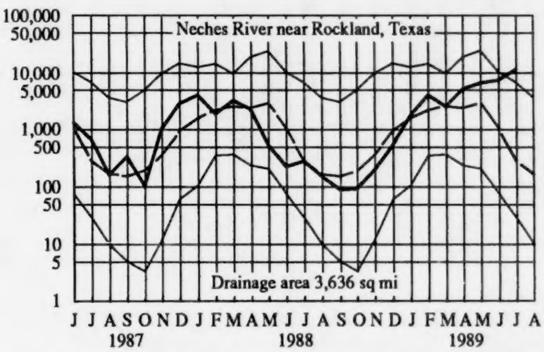


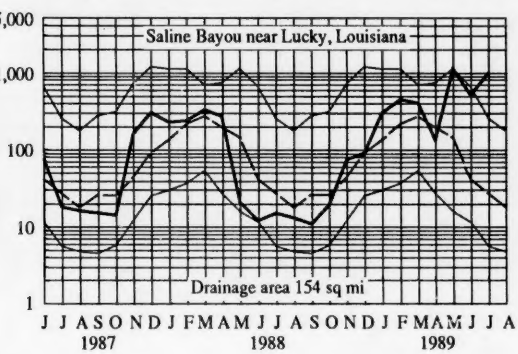
DISCHARGE IN CUBIC FEET PER SECOND

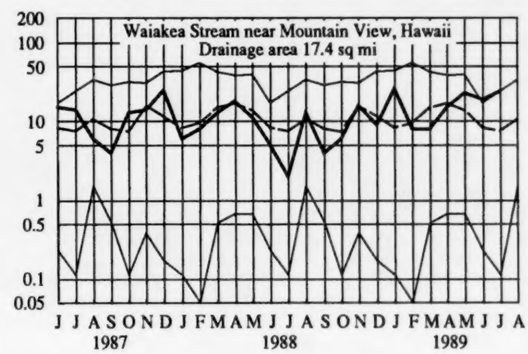




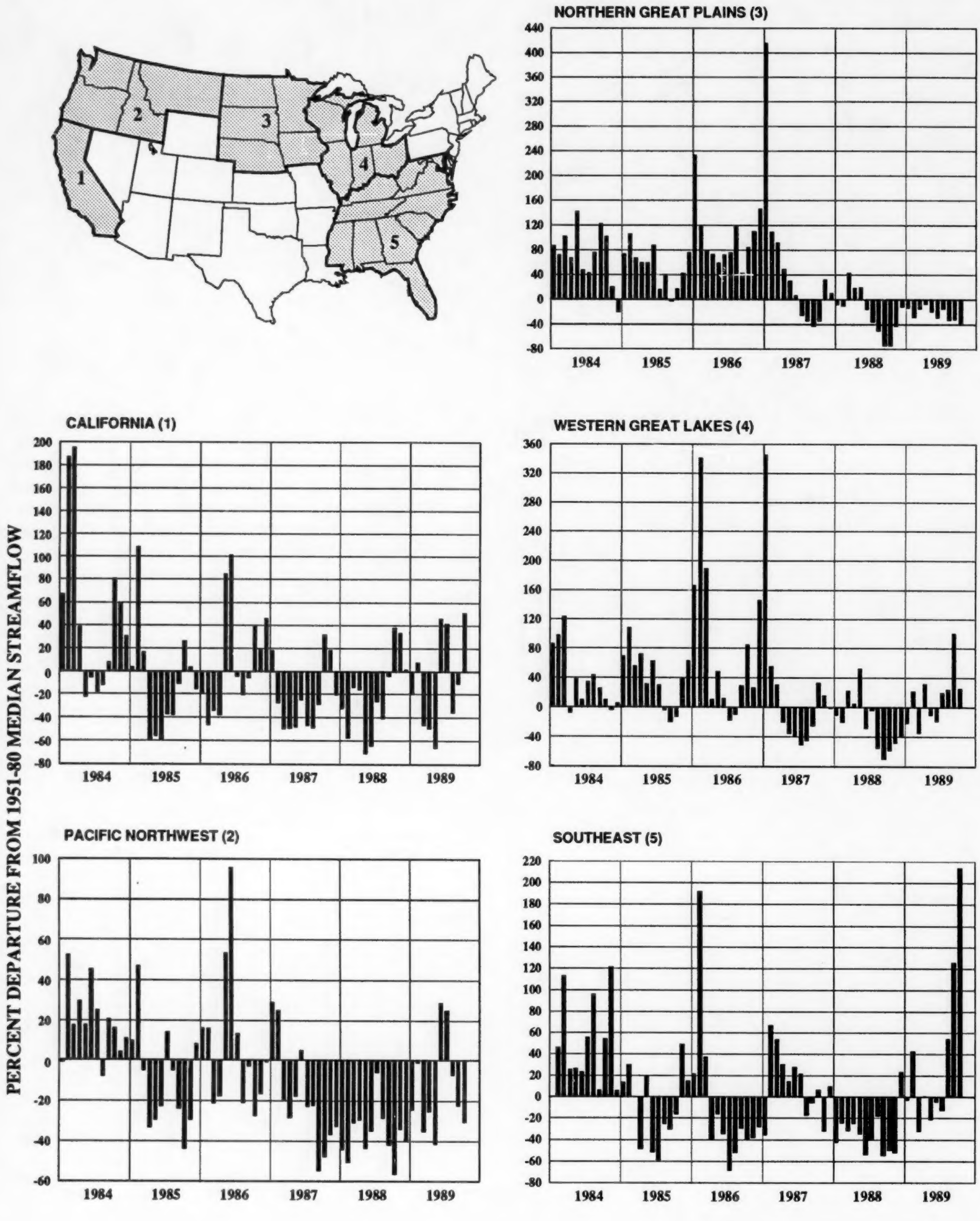




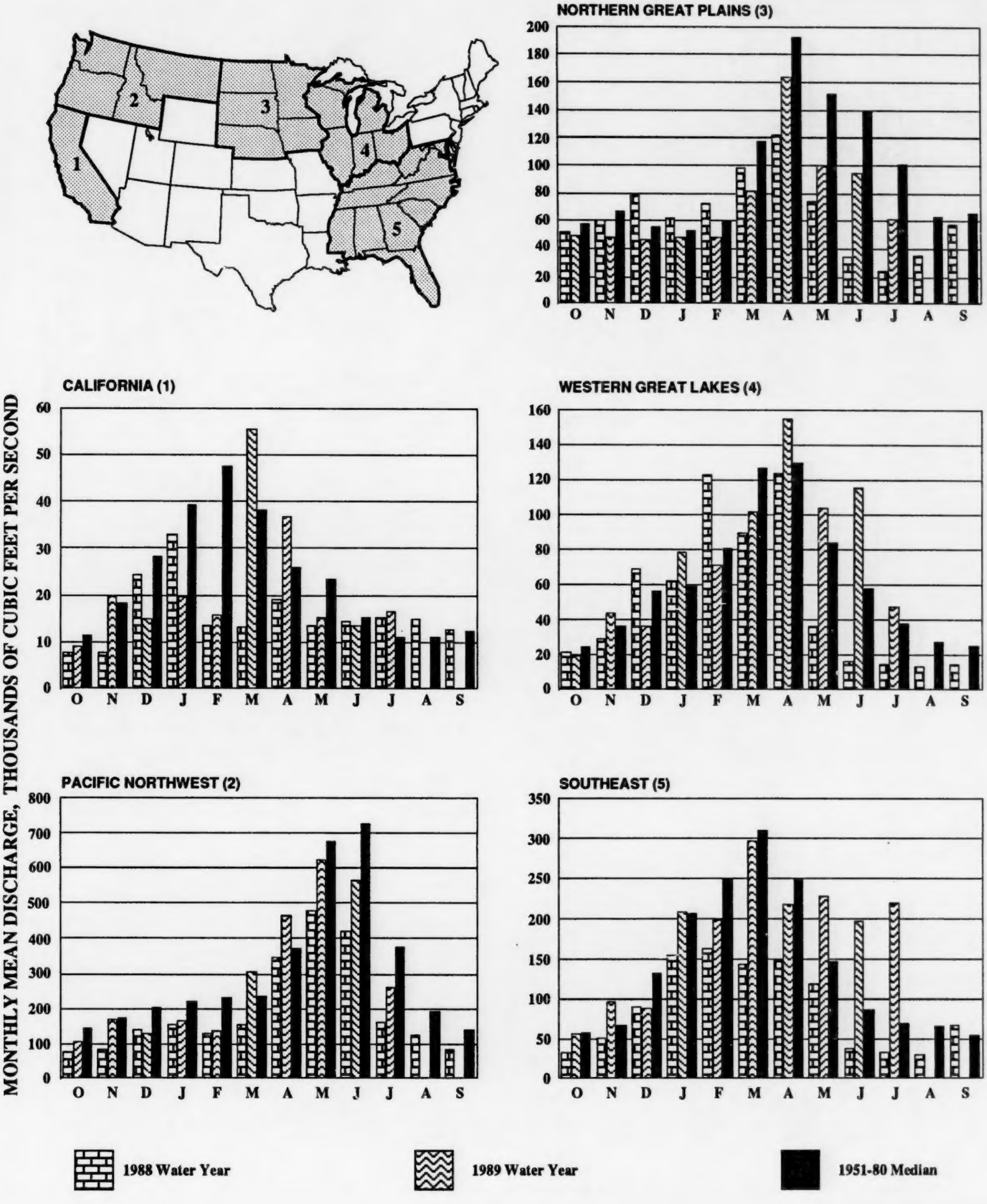




MONTHLY DEPARTURE OF ACTUAL STREAMFLOW (OCTOBER 1983-JULY 1989) FROM MEDIAN STREAMFLOW (1951-80)

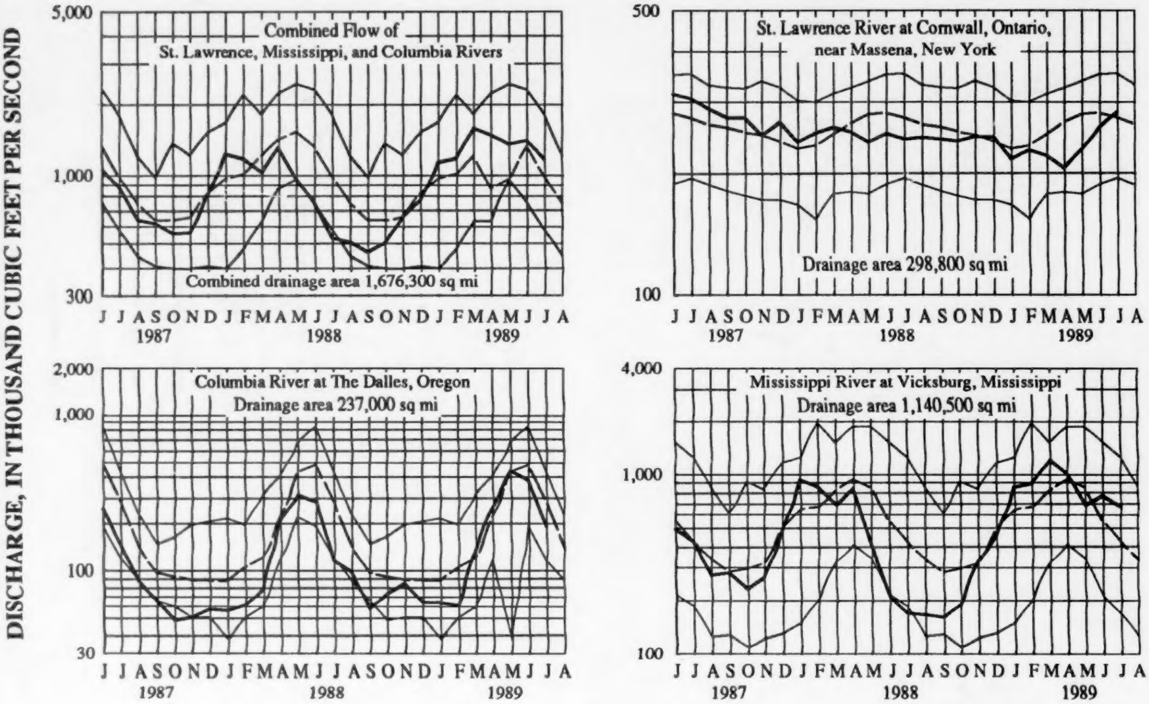


ACTUAL MONTHLY STREAMFLOW, 1988 AND 1989 WATER YEARS, COMPARED WITH MEDIAN MONTHLY STREAMFLOW, 1951-80



HYDROGRAPHS FOR THE "BIG THREE" RIVERS

Area between light-weight solid lines indicates range between highest and lowest record for the month. Dashed line indicates median of monthly values for reference period, 1951-80. Heavy line indicates mean for current period.



Provisional data; subject to revision

DISSOLVED SOLIDS AND WATER TEMPERATURES, FOR JULY 1989, AT DOWNSTREAM SITES ON FIVE LARGE RIVERS

Station number	Station name	July data of following calendar years	Stream discharge during month	Dissolved-solids concentration[a]		Dissolved-solids discharge[a]			Water temperature[b]		
			Mean (cfs)	Minimum (mg/L)	Maximum (mg/L)	Mean (tons per day)	Minimum (tons per day)	Maximum (tons per day)	Mean in °C	Minimum in °C	Maximum in °C
01463500	Delaware River at Trenton, N.J.	1989	8,378	97	124	2,494	1,689	3,947	24.5	22.0	28.0
	(Morrisville, Pa.)	1945-88	7,174	57	145	2,193	465	16,700	25.5	18.5	33.5
		(Extreme yr)		(1947)	(1978)		(1965)	(1969)			
			[c]4,822								
07289000	Mississippi River at	1989	673,935	188	243	369,757	252,573	551,123	27.5	26.0	29.0
	Vicksburg, Miss.	1976-88	481,600	200	330	321,500	114,300	633,000	29.0	23.5	34.5
		(Extreme yr)		(1981)	(1988)		(1988)	(1980)			
			[c]421,700								
03612500	Ohio River at lock and dam 53,	1989	333,400	187	222	----	92,400	288,000	---	23.0	25.0
	near Grand Chain, Ill. (stream-	1955-88	153,900	124	276	----	23,700	237,000	---	16.5	31.0
	flow station at Metropolis, Ill.)	(Extreme yr)		(1965)	(1968, 1988)		(1988)	(1958)			
			[c]143,700								
06934500	Missouri River at Hermann,	1989	47,874	348	461	55,026	45,000	59,600	27.0	23.0	30.0
	Mo. (60 miles west of	1976-88	98,850	201	501	92,430	44,700	208,000	28.0	22.0	32.5
	St. Louis, Mo.)	(Extreme yr)		(1981)	(1985)		(1977)	(1984)			
			[c]75,690								
14128910	Columbia River at Warrendale,	1989	----	---	---	----	----	----	---	---	---
	Oreg. (streamflow station at	1976-88	172,600	60	93	34,850	12,500	65,100	19.0	15.5	22.0
	The Dalles, Oreg.)	(Extreme yr)		(1976)	(1977)		(1977)	(1981)			
			[c]279,500								

[a]Dissolved-solids concentrations, when not analyzed directly, are calculated on basis of measurements of specific conductance.
[b]To convert °C to °F: [(1.8 X °C) + 32] = °F.
[c]Median of monthly values for 30-year reference period, water years 1951-80, for comparison with data for current month.

Provisional data; subject to revision

FLOW OF LARGE RIVERS DURING JULY 1989

Station number	Stream and place of determination	Drainage area (square miles)	Average discharge through September 1985 (cubic feet per second)	July 1989: Monthly mean discharge (cubic feet per second)	July 1989: Percent of median monthly discharge 1951-80	July 1989: Change in discharge from previous month (percent)	Discharge near end of month: Cubic feet per second	Discharge near end of month: Million gallons per day	Date
01014000	St. John River below Fish River at Fort Kent, Maine	5,665	9,758	2,876	62	–75	1,970	1,270	31
01318500	Hudson River at Hadley, New York	1,664	2,908	1,470	142	–48	1,150	743	31
01357500	Mohawk River at Cohoes, New York	3,456	5,683	2,390	128	–69	1,050	678	31
01463500	Delaware River at Trenton, New Jersey	6,780	11,670	8,380	174	–53	5,240	3,390	31
01570500	Susquehanna River at Harrisburg, Pennsylvania	24,100	34,340	39,400	332	–37	30,100	19,400	26
01646500	Potomac River near Washington, District of Columbia	11,560	[1]11,500	[1]12,600	314	–9	11,300	7,300	31
02105500	Cape Fear River at William O. Huske Lock, near Tarheel, North Carolina	4,852	5,002	4,754	243	–4	...	...	...
02131000	Pee Dee River at Peedee, South Carolina	8,830	9,871	26,450	465	213	9,600	6,200	30
02226000	Altamaha River at Doctortown, Georgia	13,600	13,730	14,130	213	105	19,600	12,670	31
02320500	Suwannee River at Branford, Florida	7,880	6,986	4,706	91	55	...	...	...
02358000	Apalachicola River at Chattahoochee, Florida	17,200	22,420	33,620	249	32	20,200	13,100	31
02467000	Tombigbee River at Demopolis lock and dam, near Coatopa, Alabama	15,385	23,520	47,160	750	9	24,300	15,700	31
02489500	Pearl River near Bogalusa, Louisiana	6,573	9,880	13,170	407	–40	7,240	4,680	31
03049500	Allegheny River at Natrona, Pennsylvania	11,410	[1]19,580	[1]15,360	256	–67	7,300	4,720	30
03085000	Monongahela River at Braddock, Pennsylvania	7,337	[1]12,480	[1]10,930	271	–30	10,500	6,790	30
03193000	Kanawha River at Kanawha Falls, West Virginia	8,367	12,550	9,583	187	–35	7,470	4,830	30
03234500	Scioto River at Higby, Ohio	5,131	4,583	3,931	233	–60	4,220	2,730	31
03294500	Ohio River at Louisville, Kentucky[2]	91,170	115,800	111,100	227	–51	93,700	60,560	30
03377500	Wabash River at Mount Carmel, Illinois	28,635	27,660	25,010	161	–53	27,800	17,970	31
03469000	French Broad River below Douglas Dam, Tennessee	4,543	[1]6,739	[1]9,167	222	–16	...	...	...
04084500	Fox River at Rapide Croche Dam, near Wrightstown, Wisconsin[2]	6,010	4,238	2,006	84	–76	1,980	1,280	31
04264331	St. Lawrence River at Cornwall, Ontario, near Massena, New York[3]	298,800	243,900	281,000	103	8	277,000	179,000	31
02NG001	St. Maurice River at Grand Mere, Quebec	16,300	24,910	8,200	41	–74	1,500	970	31
05082500	Red River of the North at Grand Forks, North Dakota	30,100	2,593	927	35	–57	556	359	27
05133500	Rainy River at Manitou Rapids, Minnesota	19,400	12,920	26,000	158	–2	20,000	13,000	22
05330000	Minnesota River near Jordan, Minnesota	16,200	3,680	724	17	–31	690	445	31
05331000	Mississippi River at St. Paul, Minnesota	36,800	[1]11,020	5,662	43	–31	4,370	2,820	31
05365500	Chippewa River at Chippewa Falls, Wisconsin	5,650	5,149	2,875	91	–37	2,370	1,530	31
05407000	Wisconsin River at Muscoda, Wisconsin	10,400	8,710	3,580	63	–69	3,460	2,230	31
05446500	Rock River near Joslin, Illinois	9,549	6,080	2,010	58	–41	3,120	2,020	31
05474500	Mississippi River at Keokuk, Iowa	119,000	63,790	25,590	41	–53	18,100	11,700	31
06214500	Yellowstone River at Billings, Montana	11,795	7,056	11,090	74	–51	6,740	4,360	31
06934500	Missouri River at Hermann, Missouri	524,200	80,880	47,880	63	–16	58,000	37,500	31
07289000	Mississippi River at Vicksburg, Mississippi[4]	1,140,500	584,000	673,900	160	–12	414,000	267,600	28
07331000	Washita River near Dickson, Oklahoma	7,202	1,402	1,760	423	–79	917	592	31
08276500	Rio Grande below Taos Junction Bridge, near Taos, New Mexico	9,730	742	246	75	–53	254	164	27
09315000	Green River at Green River, Utah	44,850	6,391	1,525	27	–71	1,160	750	27
11425500	Sacramento River at Verona, California	21,251	19,430	15,690	161	45	18,160	11,740	23
13269000	Snake River at Weiser, Idaho	69,200	18,520	8,800	79	–31	9,630	6,220	31
13317000	Salmon River at White Bird, Idaho	13,550	11,390	7,480	51	–70	4,640	3,000	31
13342500	Clearwater River at Spalding, Idaho	9,570	15,510	7,720	70	–77	4,040	2,610	31
14105700	Columbia River at The Dalles, Oregon[5]	237,000	[1]193,500	[1]191,300	68	–49	111,500	72,060	26
14191000	Willamette River at Salem, Oregon	7,280	[1]23,690	[1]5,063	92	–59	5,890	3,810	27
15515500	Tanana River at Nenana, Alaska	25,600	23,810	68,600	118	33	60,000	39,000	31
08MF005	Fraser River at Hope, British Columbia	83,800	96,250	146,100	77	–31	116,200	75,100	31

[1]Adjusted.

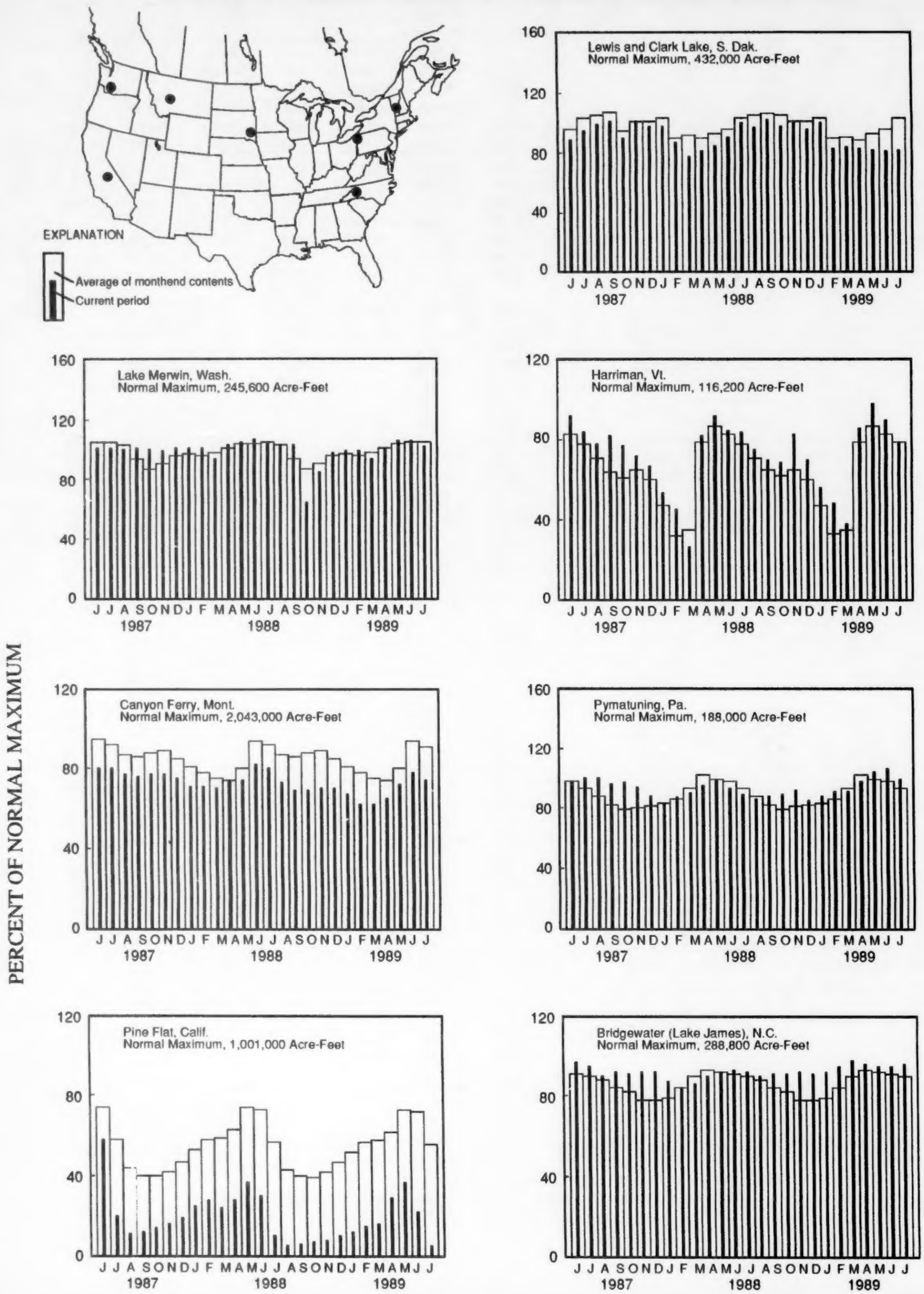
[2]Records furnished by Corps of Engineers.

[3]Records furnished by Buffalo District, Corps of Engineers, through International St. Lawrence River Board of Control. Discharges shown are considered to be the same as discharge at Ogdensburg, N.Y., when adjusted for storage in Lake St. Lawrence.

[4]Records of daily discharge computed jointly by Corps of Engineers and Geological Survey.

[5]Discharge determined from information furnished by Bureau of Reclamation, Corps of Engineers, and Geological Survey.

USABLE CONTENTS OF SELECTED RESERVOIRS AND RESERVOIR SYSTEMS



USABLE CONTENTS OF SELECTED RESERVOIRS NEAR END OF JULY 1989

[Contents are expressed in percent of reservoir (system) capacity. The usable storage capacity of each reservoir (system) is shown in the column headed "Normal maximum"]

Reservoir Principal uses: F-Flood control I-Irrigation M-Municipal P-Power R-Recreation W-Industrial	Percent of normal maximum: End of July 1989	End of July 1988	Average for end of July	End of June 1989	Normal maximum (acre-feet)[a]
NOVA SCOTIA					
Rossignol, Mulgrave, Falls Lake, St. Margaret's Bay, Black, and Ponhook Reservoirs (P)	69	55	60	76	[b]226,300
QUEBEC					
Allard (P)	80	81	76	88	280,600
Gouin (P)	65	40	69	68	6,954,000
MAINE					
Seven Reservoir Systems (MP)	78	68	78	90	4,107,000
NEW HAMPSHIRE					
First Connecticut Lake (P)	78	87	88	87	76,450
Lake Francis (FPR)	82	77	86	92	99,310
Lake Winnipesaukee (PR)	94	97	88	98	165,700
VERMONT					
Harriman (P)	79	84	79	90	116,200
Somerset (P)	85	77	82	95	57,390
MASSACHUSETTS					
Cobble Mountain and Borden Brook (MP)	93	82	83	96	77,920
NEW YORK					
Great Sacandaga Lake (FPR)	90	76	83	100	786,700
Indian Lake (FMP)	96	97	91	97	103,300
New York City Reservoir System (MW)	94	84	90	100	1,680,000
NEW JERSEY					
Wanaque (M)	93	76	82	100	77,450
PENNSYLVANIA					
Allegheny (FPR)	47	44	45	70	1,180,000
Pymatuning (FMR)	99	89	93	106	188,000
Raystown Lake (FR)	68	67	63	68	761,900
Lake Wallenpaupack (PR)	71	75	74	76	157,800
MARYLAND					
Baltimore Municipal System)	98	90	91	99	261,900
NORTH CAROLINA					
Bridgewater (Lake James) (P)	96	92	90	95	288,800
Narrows (Badin Lake) (P)	94	94	97	95	128,900
High Rock Lake (P)	91	59	77	95	234,800
SOUTH CAROLINA					
Lake Murray (P)	93	88	78	93	1,614,000
Lakes Marion and Moultrie (P)	89	74	72	102	1,862,000
SOUTH CAROLINA-GEORGIA					
Strom Thurmond Lake (FP)	71	35	69	58	1,730,000
GEORGIA					
Burton (PR)	97	97	92	99	104,000
Sinclair (MPR)	89	89	90	85	214,000
Lake Sidney Lanier (FMPR)	68	42	60	63	1,686,000
ALABAMA					
Lake Martin (P)	99	88	90	99	1,375,000
TENNESSEE VALLEY					
Clinch Projects: Norris and Melton Hill Lakes (FPR)	75	39	55	83	2,293,000
Douglas Lake (FPR)	89	36	61	95	1,395,000
Hiwassee Projects: Chatuge, Nottely, Hiwassee, Apalachia, Blue Ridge, Ocoee 3, and Parksville Lakes (FPR)	94	63	76	96	1,012,000
Holston Projects: South Holston, Watauga, Boone, Fort Patrick Henry, and Cherokee Lakes (FPR)	85	47	62	90	2,880,000
Little Tennessee Projects: Nantahala, Thorpe, Fontana, and Chilhowee Lakes (FPR)	93	55	75	99	1,478,000
WISCONSIN					
Chippewa and Flambeau (PR)	82	79	83	92	365,000
Wisconsin River (21 Reservoirs) (PR)	68	54	74	82	399,000
MINNESOTA					
Mississippi River Headwater System (FMR)	40	32	38	46	1,640,000
NORTH DAKOTA					
Lake Sakakawea (Garrison) (FIPR)	66	71	92	67	22,700,000
SOUTH DAKOTA					
Angostura (I)	44	54	83	50	130,770
Belle Fourche (I)	37	41	55	60	185,200
Lake Francis Case (FIP)	78	79	85	81	4,589,000
Lake Oahe (FIP)	61	76	...	63	22,240,000
Lake Sharpe (FIP)	102	103	101	100	1,697,000
Lewis and Clark Lake (FIP)	82	100	103	81	432,000
NEBRASKA					
Lake McConaughy (IP)	64	71	75	74	1,948,000
OKLAHOMA					
Eufaula (FRP)	98	94	90	104	2,378,000
Keystone (FPR)	92	81	94	102	661,000
Tenkiller Ferry (FPR)	104	100	97	100	628,200
Lake Altus (FIMR)	82	79	65	99	133,000
Lake O'The Cherokees (FPR)	96	93	91	97	1,492,000
OKLAHOMA-TEXAS					
Lake Texoma (FMPRW)	99	88	100	132	2,722,000
TEXAS					
Bridgeport (IMW)	100	77	54	100	386,400
Canyon (FMR)	93	106	82	96	385,600
International Amistad (FIMPW)	85	97	76	87	3,497,000
International Falcon (FIMPW)	57	72	66	61	2,668,000
Livingston (IMW)	100	88	89	109	1,788,000
Possum Kingdom (IMPRW)	97	69	96	99	570,200
Red Bluff (P)	36	61	25	44	307,000
Toledo Bend (P)	100	85	89	103	4,472,000
Twin Buttes (FIM)	61	77	31	68	177,800
Lake Kemp (IMW)	92	71	89	100	268,000
Lake Meredith (FMW)	41	41	38	42	796,900
Lake Travis (FIMPRW)	73	85	79	81	1,144,000
MONTANA					
Canyon Ferry (FIMPR)	74	80	91	78	2,043,000
Fort Peck (FPR)	68	75	90	69	18,910,000
Hungry Horse (FIPR)	86	55	96	87	3,451,000
WASHINGTON					
Ross (PR)	99	99	96	98	1,052,000
Franklin D. Roosevelt Lake (IP)	86	88	99	80	5,022,000
Lake Chelan (PR)	99	99	98	95	676,100
Lake Cushman (PR)	93	100	100	92	359,500
Lake Merwin (P)	102	105	105	106	245,600
IDAHO					
Boise River (4 Reservoirs) (FIP)	70	37	75	79	1,235,000
Coeur d'Alene Lake (P)	100	97	82	99	238,500
Pend Oreille Lake (FP)	90	97	96	95	1,561,000
IDAHO-WYOMING					
Upper Snake River (8 Reservoirs) (MP)	50	40	71	83	4,401,000
WYOMING					
Boysen (FIP)	86	65	89	80	802,000
Buffalo Bill (IP)	88	55	100	88	421,300
Keyhole (F)	25	33	48	30	193,800
Pathfinder, Seminoe, Alcova, Kortes, Glendo, and Guernsey Reservoirs (I)	47	67	62	57	3,056,000
COLORADO					
John Martin (FIR)	16	43	23	27	364,400
Taylor Park (IR)	95	92	91	94	106,200
Colorado-Big Thompson Project (I)	58	85	73	68	730,300
COLORADO RIVER STORAGE PROJECT					
Lake Powell; Flaming Gorge, Fontenelle, Navajo, and Blue Mesa Reservoirs (IFPR)	83	90	...	85	31,620,000
UTAH-IDAHO					
Bear Lake (IPR)	57	67	69	64	1,421,000
CALIFORNIA					
Folsom (FIP)	73	32	76	88	1,000,000
Hetch Hetchy (MP)	94	80	80	100	360,400
Isabella (FIR)	24	18	45	31	568,100
Pine Flat (FI)	5	10	56	22	1,001,000
Clair Engle Lake (Lewiston) (P)	72	80	85	79	2,438,000
Lake Almanor (P)	86	82	65	91	1,036,000
Lake Berryessa (FIMW)	56	67	82	59	1,600,000
Millerton Lake (FI)	36	39	65	65	503,200
Shasta Lake (FIPR)	60	49	78	70	4,377,000
CALIFORNIA-NEVADA					
Lake Tahoe (IPR)	24	18	70	26	744,600
NEVADA					
Rye Patch (I)	25	24	71	32	194,300
ARIZONA-NEVADA					
Lake Mead and Lake Mohave (FIMP)	82	88	76	83	27,970,000
ARIZONA					
San Carlos (IP)	16	35	22	25	935,100
Salt and Verde River System (IMPR)	60	83	46	67	2,019,100
NEW MEXICO					
Conchas (FIR)	66	83	81	69	315,700
Elephant Butte and Caballo (FIPR)	75	86	36	80	2,442,000

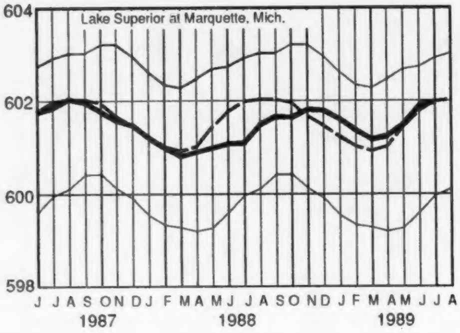
[a]1 acre-foot = 0.04356 million cubic feet = 0.326 million gallons = 0.504 cubic feet per second per day.

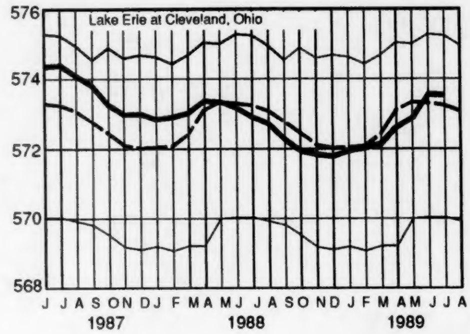
[b]Thousands of kilowatt-hours (the potential electric power that could be generated by the volume of water in storage)

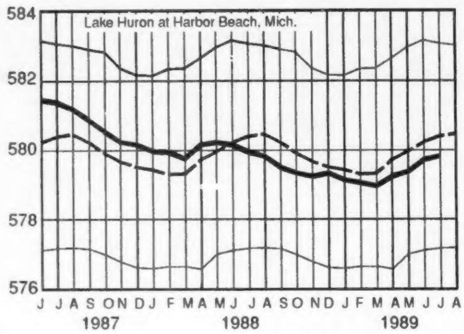
GREAT LAKES ELEVATIONS

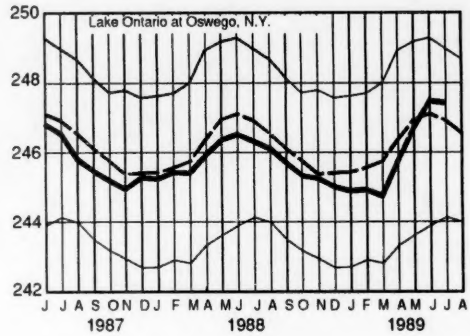
Area between light-weight solid lines indicates range between highest and lowest record for the month. Dashed line indicates median of monthly values for reference period, 1951-80. Heavy line indicates mean for current period. Data from National Ocean Service.

ELEVATION, IN FEET ABOVE NATIONAL GEODETIC VERTICAL DATUM OF 1929

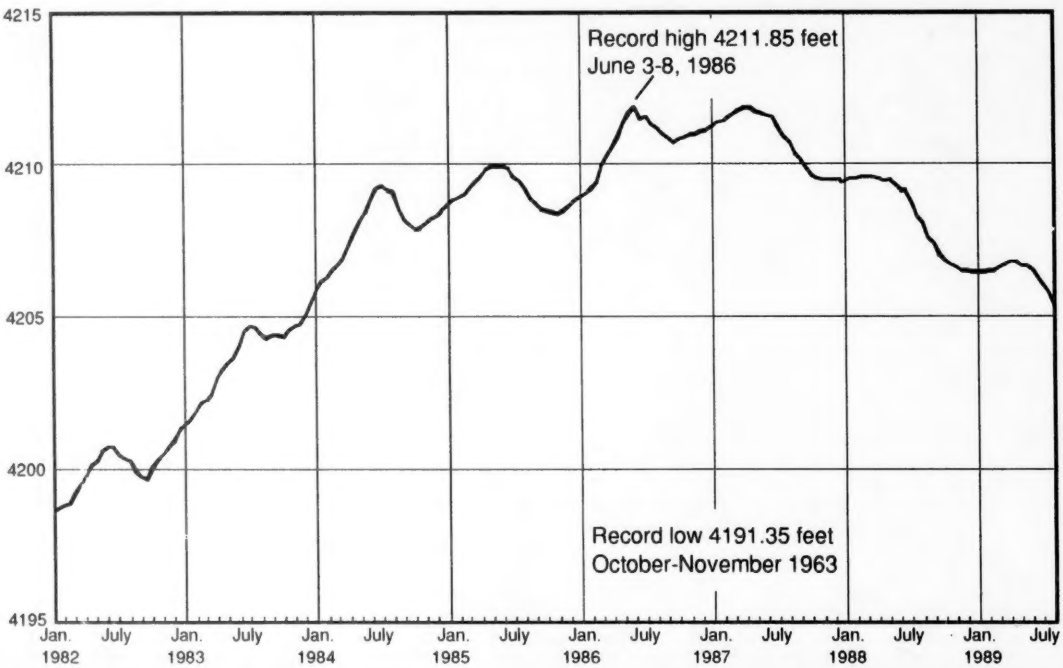


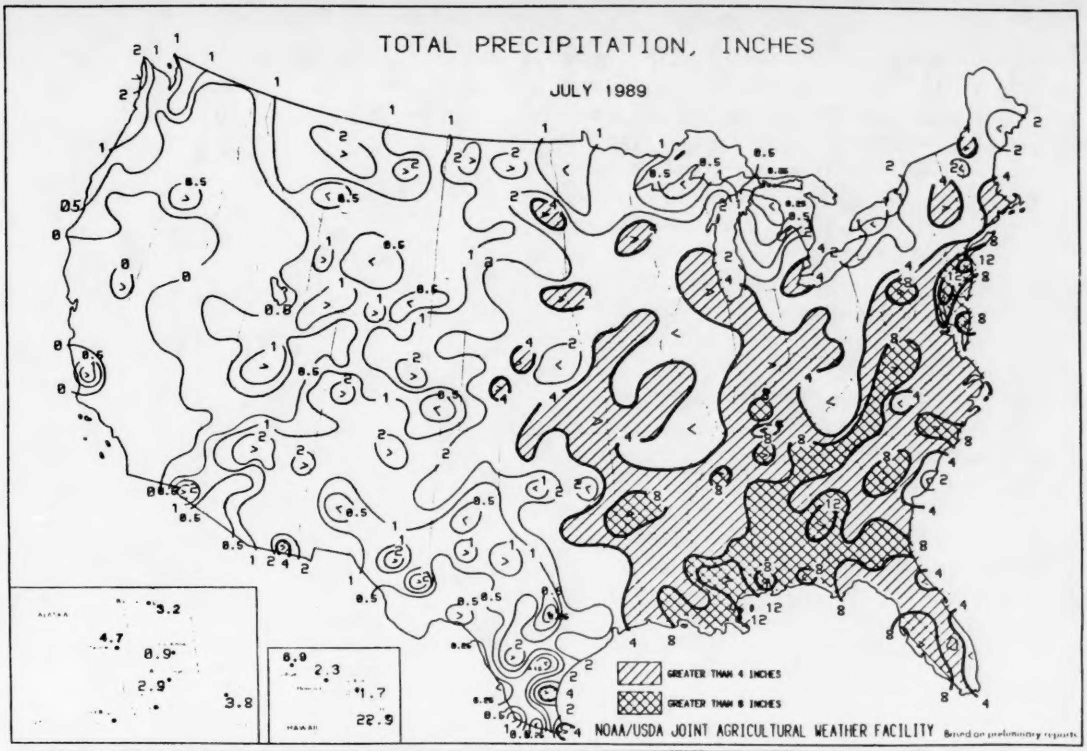


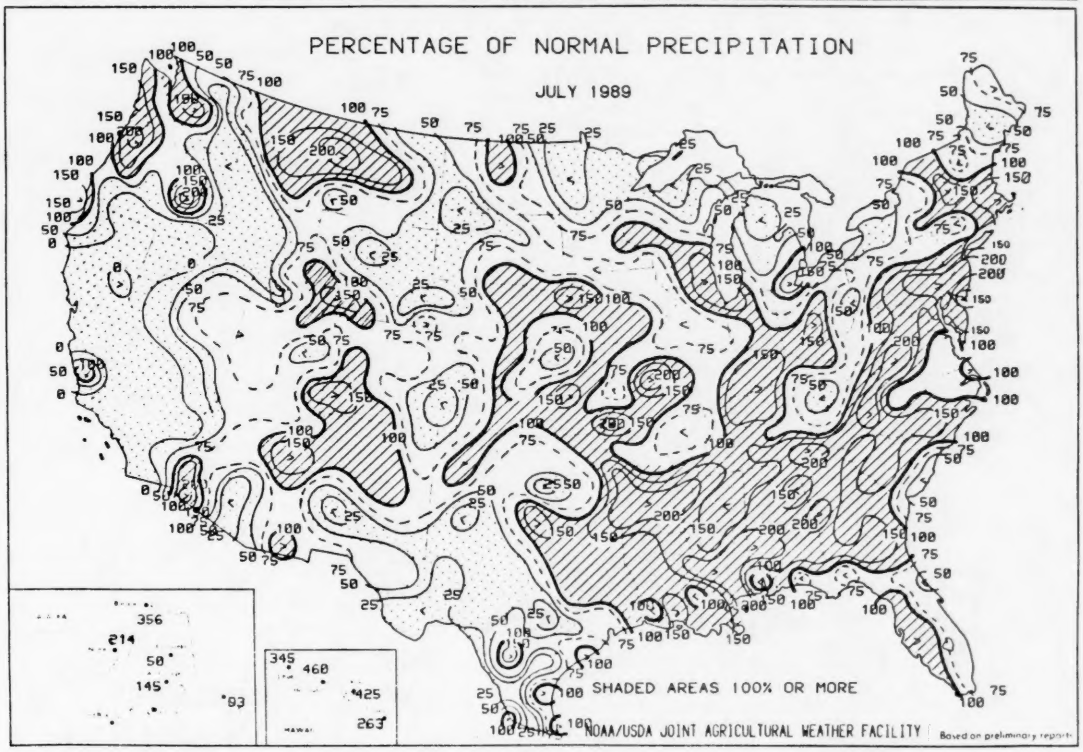




Fluctuations of Great Salt Lake, January 1982 through July 1989







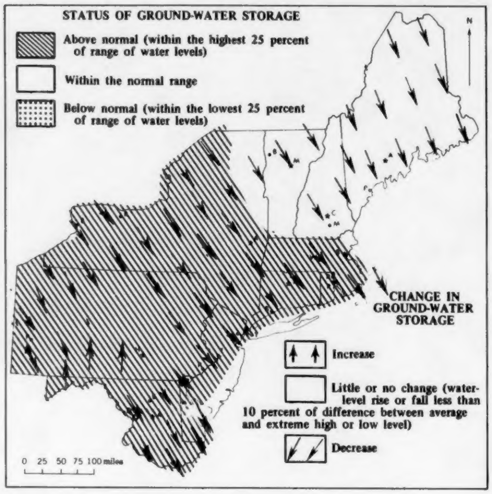
(From *Weekly Weather and Crop Bulletin* prepared and published by the NOAA/USDA Joint Agricultural Weather Facility)

GROUND-WATER CONDITIONS DURING JULY 1989

Ground-water levels remained above normal in most of the southern two-thirds of the Northeast Region in spite of seasonal declines. In the north, levels remained in the normal range. Water levels rose only in south-central Pennsylvania and western Maryland. Levels remained essentially unchanged in a few areas in the central and southern parts of the Northeast and in the coastal areas of New Jersey and Long Island, New York.

Ground-water levels throughout most of the southeastern States were mixed with respect to last month. Levels declined in West Virginia and Louisiana and rose in Florida. Levels were above long-term averages in most areas except for Arkansas and Louisiana, where they were mixed, and Florida, where they were consistently below average. Monthly high levels were recorded at key wells in West Virginia, Kentucky, and Virginia at Glenville, the Viola well in Graves County, and the Tyler well in Louisa County, respectively. A record low level occurred in Arkansas at the Pine Bluff well in Jefferson County.

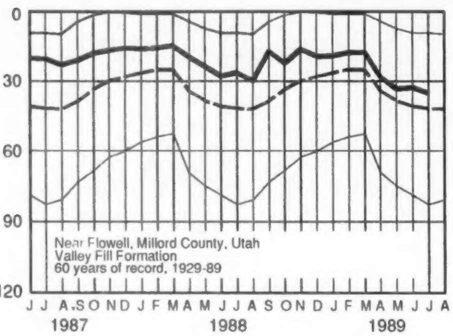
In the central and western Great Lakes States ground-water levels fell throughout most of Minnesota, Michigan, and Ohio. Levels were mixed elsewhere in the region with respect to levels last

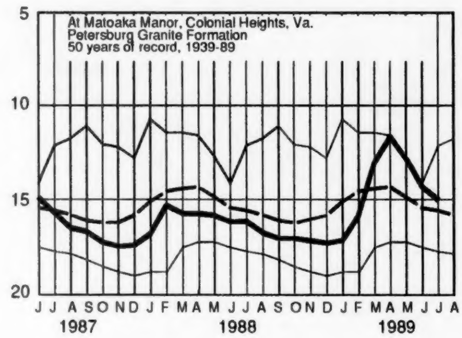


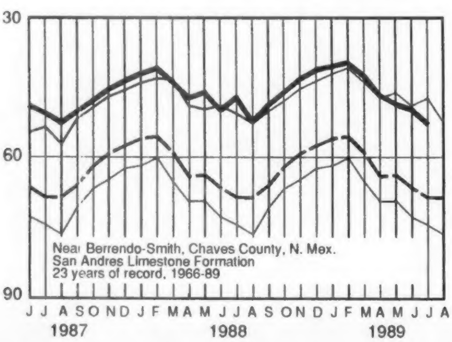
Map showing ground-water storage near end of June and change in ground-water storage from end of May to end of June.

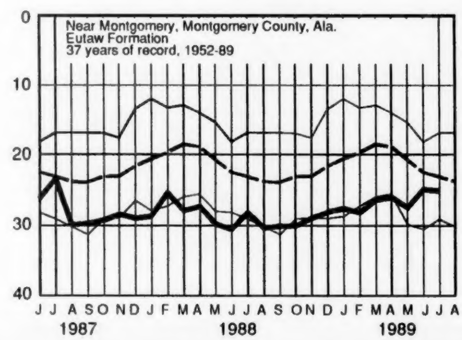
MONTHEND GROUND-WATER LEVELS IN KEY WELLS

Area between light-weight solid lines indicates range between highest and lowest record for the month. Dashed line indicates average of monthly levels in previous years. Heavy line indicates level for current period.









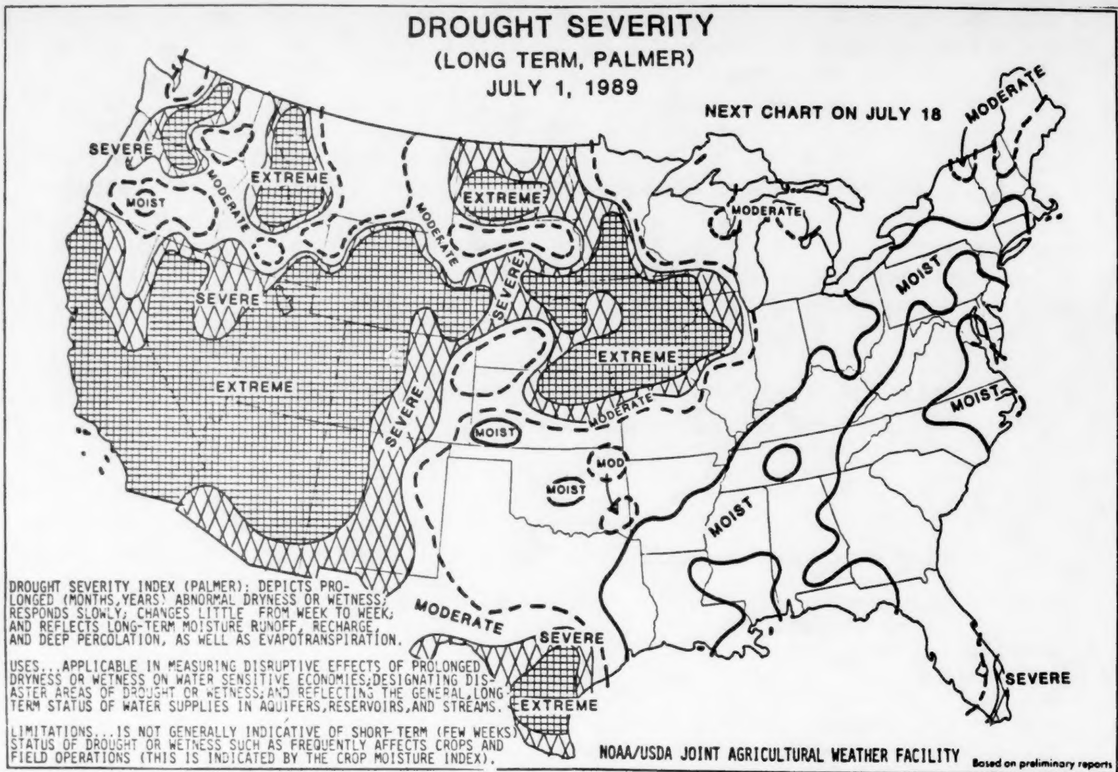
month. Water levels were below long-term averages throughout Minnesota, but were at or above average in most of Michigan and Ohio and mixed with respect to average in Iowa. A July high level occurred in a key well in Franklin County in central Ohio.

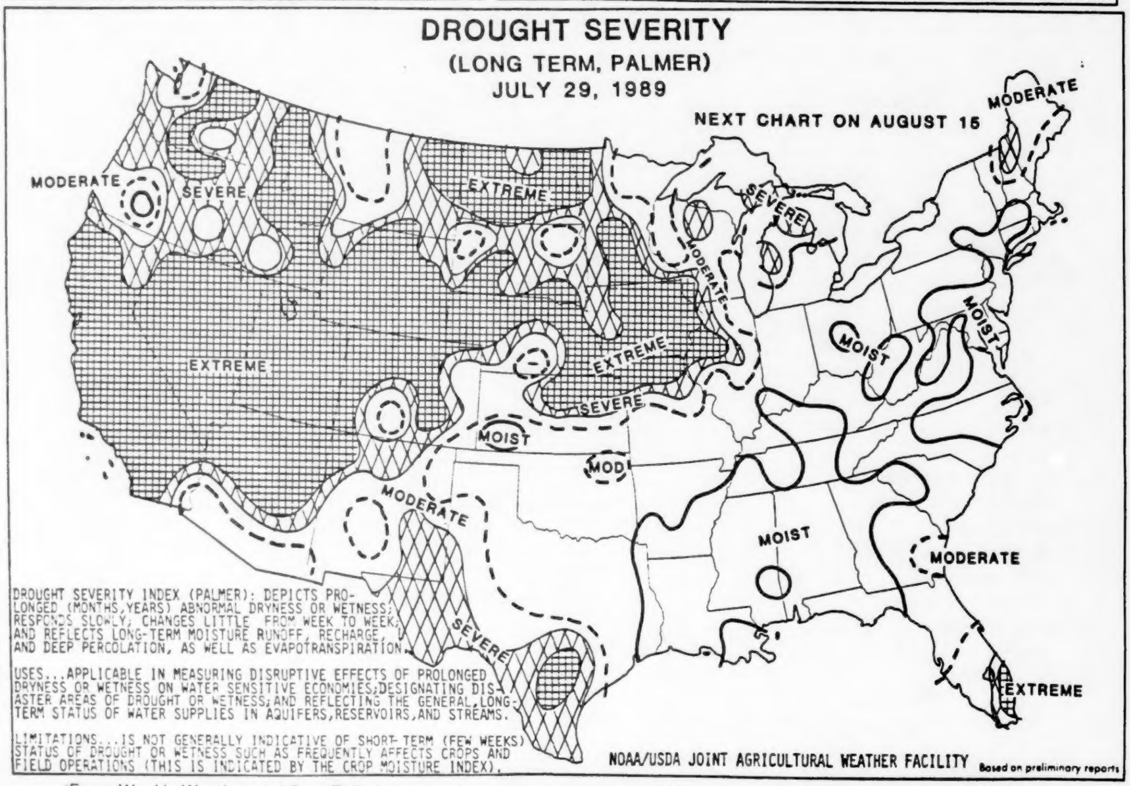
Ground-water levels continued to fall in most of the Western States, except in Idaho and Texas where changes were mixed with respect to last month. Levels were below long-term averages in much of the west, including Washington, Idaho, North Dakota, California, Kansas, and Arizona. Elsewhere levels were mixed with respect to average. All-time low water levels occurred in key wells in the Las Vegas area of Nevada, the Holladay area of Utah, and in Kansas in Harvey County, and at the Kansas Agricultural Experimental Station in Thomas County where water levels have set monthly or all-time record lows every month since September 1987. A July record low occurred in a key well in El Paso, Texas.

Provisional data; subject to revision

WATER LEVELS IN KEY OBSERVATION WELLS IN SOME REPRESENTATIVE AQUIFERS IN THE CONTERMINOUS UNITED STATES--JULY 1989

Aquifer and Location	Water level in feet with reference to land-surface datum	Departure from average in feet	Net change in water level in feet since: Last month	Last year	Year records began	Remarks
Glacial drift at Hanska, south-central Minnesota	-7.88	-1.44	-0.23	+1.12	1942	
Glacial drift at Roscommon in north-central part of Lower Peninsula, Michigan.	-4.84	-0.19	-0.76	+0.57	1935	
Glacial drift at Marion, Iowa	-5.16	+0.04	+1.16	+2.26	1941	
Glacial drift at Princeton in northwestern Illinois	-10.00	+1.73	-1.82	+0.64	1943	
Petersburg Granite, southeastern Piedmont near Fall Zone, Colonial Heights, Virginia.	-15.02	+0.60	-0.69	+1.13	1939	
Glacial outwash sand and gravel, Louisville, Kentucky (U.S. well no. 2).	-18.78	+5.67	+0.24	+1.25	1946	
500-foot sand aquifer near Memphis, Tennessee (U.S. well no. 2).	-106.43	-15.86	+0.03	+1.19	1941	
Weathered granite, Mocksville area, Davie County, western Piedmont, North Carolina.	-16.65	+3.38	-0.62	+3.04	1932	
Sparta Sand in Pine Bluff industrial area, Arkansas	-238.00	-29.95	-0.50	-2.67	1958	July low
Eutaw Formation in the City of Montgomery, Alabama (U.S. well no. 4).	-25.1	-2.1	-0.2	-3.1	1952	
Upper Floridan aquifer on Cockspur Island, Savannah area, Georgia (U.S. well no. 6).	-37.54	-9.08	+0.13	+1.31	1956	
Sand and gravel in Puget Trough, Tacoma, Washington.	-115.78	-4.63	-1.40	-1.50	1952	
Pleistocene glacial outwash gravel, North Pole, northern Idaho (U.S. well no. 3).	-466.2	-6.6	+1.1	+1.6	1929	
Snake River Group: Snake River Plain Aquifer, at Eden, Idaho (U.S. well no. 4).	-121.9	-4.1	+2.3	-1.3	1957	
Alluvial valley fill in Flowell area, Millard County, Utah (U.S. well no. 9).	-35.30	+4.12	-2.35	-8.78	1929	
Alluvial sand and gravel, Platte River Valley, Ashland, Nebraska (U.S. well no. 6).	-7.55	-2.14	-0.38	-0.67	1935	
Alluvial valley fill in Steptoe Valley, Nevada	-8.23	+4.51	-0.87	-0.19	1950	
Pleistocene terrace deposits in Kansas River valley, at Lawrence, northeastern Kansas.	-24.60	-4.18	-0.50	-2.28	1953	
Alluvium and Paso Robles clay, sand, and gravel, Santa Maria Valley, California.	-146.0	-6.15	-0.25	-11.34	1957	
Valley fill, Elfrida area, Douglas, Arizona (U.S. well no. 15).	-99.91	-16.27	-0.02	+1.42	1951	
Hueco bolson, El Paso area, Texas	-272.66	-19.82	+1.03	-1.12	1965	July low
Evangeline aquifer, Houston area, Texas	-295.53	+6.17	-0.04	+5.85	1965	





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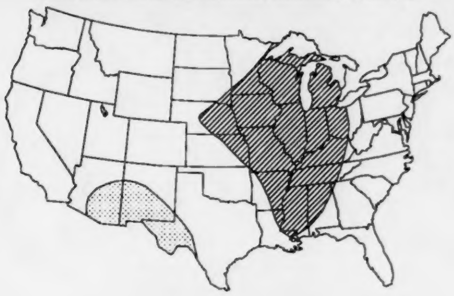
TEMPERATURE OUTLOOK FOR AUGUST THROUGH OCTOBER 1989

PRECIPITATION OUTLOOK FOR AUGUST THROUGH OCTOBER 1989



NATIONAL WATER CONDITIONS

JULY 1989

Based on reports from the Canadian and U.S. Field offices; completed August 15, 1989

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The National Water Conditions is published monthly. Subscriptions are free on application to the U.S. Geological Survey, 419 National Center, Reston, VA 22092.

EXPLANATION OF DATA (Revised April 1989)

Cover map shows generalized pattern of streamflow for the month based on provisional data from 183 index gaging stations—18 in Canada, 163 in the United States, and 2 in the Commonwealth of Puerto Rico. Alaska, Hawaii, and Puerto Rico inset maps show streamflow only at the index gaging stations that are located near the point shown by the arrows. Classifications on map are based on comparison of streamflow for the current month at each index station with the flow for the same month in the 30-year reference period, 1951-80. Shorter reference periods are used for one Canadian index station, two Kansas index stations, and the Puerto Rico index stations because of the limited records available.

The ***streamflow ranges map*** shows where streamflow has persisted in the above- or below-normal range from last month to this month and also where streamflow is in the above- or below-normal range this month after being in a different range last month. Three ***pie charts*** show: the percent of stations reporting discharges in each flow range for both the conterminous United States and southern Canada, and also the percent of area in each flow range for the conterminous United States and southern Canada. The bar graph shows total mean and total median flow for all reporting stations in the conterminous United States and southern Canada.

The comparative data are obtained by ranking the 30 flows for each month of the reference period in order of decreasing magnitude—the highest flow is given a ranking of 1 and the lowest flow is given a ranking of 30. Quartiles (25-percent points) are computed by averaging the 7th and 8th highest flows (upper quartile), 15th and 16th highest flows (middle quartile and median), and the 23rd and 24th highest flows (lower quartile). The upper and lower quartiles set off the highest 25 percent of flows and lowest 25 percent of flows, respectively, for the reference period. The median (middle quartile) is the middle value by definition. For the reference period, 50 percent of the flows are greater than the median, 50 percent are less than the median, 50 percent are between the upper and lower quartiles (in the normal range), 25 percent are greater than the upper quartile (above normal), and 25 percent are less than the lower quartile (below normal). Flow for the current month is then classified as: in the ***above-normal range*** if it is greater than the upper quartile, in the ***normal range*** if it is between the upper and lower quartiles, and in the ***below-normal range*** if it is less than the lower quartile. Change in flow from the previous month to the current month is classified as ***seasonal*** if the change is in the same direction as the change in the median. If the change is in the opposite direction of the change in the median, the change is classified as ***contraseasonal*** (opposite to the seasonal change). For example: at a particular index station, the January median is greater than the December median; if flow for the current January increased from December (the previous month), the increase is seasonal; if flow for the current January decreased from December, the decrease is contraseasonal.

Flood frequency analyses define the relation of flood peak magnitude to probability of occurrence or recurrence interval. ***Probability of occurrence*** is the chance that a given flood magnitude will be exceeded in any one year. ***Recurrence interval*** is the reciprocal of probability of occurrence and is the average number of years between occurrences. For example, a flood having a probability of occurrence of 0.01 (1 percent) has a recurrence interval of 100 years. ***Recurrence intervals imply no regularity of occurrence***; a 100-year flood might be exceeded in consecutive years or it might not be exceeded in a 100-year period.

Statements about ***ground-water levels*** refer to conditions near the end of the month. The water level in each key observation well is compared with average level for the end of the month determined from the 30-year reference period, 1951-80, or from the entire past record for that well when only limited records are available. Comparative data for ground-water levels are obtained in the same manner as comparative data for streamflow. ***Changes in ground-water levels***, unless described otherwise, are from the end of the previous month to the end of the current month.

Dissolved solids and temperature data are given for five stream-sampling sites that are part of the National Stream Quality Accounting Network (NASQAN). ***Dissolved solids*** are minerals dissolved in water and usually consist predominately of silica and ions of calcium, magnesium, sodium, potassium, carbonate, bicarbonate, sulfate, chloride, and nitrate. ***Dissolved-solids discharge*** represents the total daily amount of dissolved minerals carried by the stream. ***Dissolved-solids concentrations*** are generally higher during periods of low streamflow, but the highest dissolved-solids discharges occur during periods of high streamflow because the total quantities of water, and therefore total load of dissolved minerals, are so much greater than at times of low flow.

★U.S. Government Printing Office: 1989-242-332/00006

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